Check List the journal of biodiversity data

NOTES ON GEOGRAPHIC DISTRIBUTION

Check List 11(4): 1716, 21 August 2015 doi: http://dx.doi.org/10.15560/11.4.1716
ISSN 1809-127X

First record of the myxomycete genus *Colloderma* in Central America

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Abstract: The myxomycete genus *Colloderma* and the species *Colloderma oculatum* are reported for the first time in Central America. The species was recorded at high elevations in the Talamanca Mountain Range in Costa Rica during 2014 in a location where the structure of myxomycete assemblages has been historically associated with temperate rather than tropical communities. Comments on the geographical distribution and ecology of the species are included. This record has increased the number of Costa Rican myxomycetes to 213 according to the most updated checklist.

Key words: biogeography, Mesoamerica, myxogastrids, Neotropics, slime molds

The myxomycete genus *Colloderma* was described by Gulielma Lister in 1910 (Lister 1910) based on specimens from Scotland and the original description of *Didymium oculatum* C. Lippert, from Austria. Lister (1910) recognized that those specimens did not belong into the Physaraceae and created the new genus with the combination of the species *Colloderma oculatum* (Lippert) G. Lister. In her description, Lister emphasized the eye-like appearance of the moist and unbroken sporangia, which inspired Lippert to use the term "oculatum" in order to describe the original specimens. In the third edition of "A monograph of the Mycetozoa" (Lister 1925) the genus *Colloderma* was included under the new family Collodermaceae, based on the outer gelatinous layer, but Nannenga-Bremekamp (1967) stated that an outer gelatinous wall occurs in other genera of myxomycetes, and by the structure of the capillitium, very close to *Diacheopsis*, she included the genus *Colloderma* in the family Stemonitidaceae ("Stemonitaceae"), a decision accepted today.

About a hundred years after the species was described, most of the records of *C. oculatum* have been found in northern temperate forests of Europe and North America (see Eliasson 1981; Schnittler and Novozhilov 1996; Stephenson 2004). For the Neotropics, few records exist, and according to Lado and Wrigley de Basanta (2008), the species has been recorded in Uruguay and Ecuador. For Uruguay the record is from Paysandú, "sobre estiércol de liebre (*Lepus europaeus* L.)" (García-Zorrón, 1977). For Ecuador there are four records (McHugh 2009) from Ayampe on *Chrisophyllum* (Sapotaceae) and a Malvaceae, and from a locality close to Machalilla on *Armatocereus* (Cactaceae). Recently, McHugh (2009), also cited *Colloderma oculatum* in several locations from Paraguay such as Lake Yapacarai, Boquerón, Guairá, Amambay and Alto Paraná, always on bark studied using the moist chamber culture technique.

In spite of such a limited known distribution, it is very likely that the geographical extent of the species may realistically show a broader pattern, which at present is masked up by research limitations of myxomycete research worldwide (see Stephenson et al. 2009). As such, the present geographical distribution note constitutes a case in which an increased effort in studying myxomycetes within a particular region has generated information that was not published yet in the scientific literature. In this manner, the objective of this work is to officially report the genus *Colloderma* and the species *C. oculatum* for the Central American region for the first time, and to enlarge the geographical distribution of both considerably. The importance of this type of notes on a group, such as the myxomycetes, relies in the fact that it provides baseline data for future projects regarding biodiversity monitoring, microbial ecology assessments and ecosystem management.

This study was carried out during 2014 as part of an academic visit of the second author to the University of Costa Rica. In an expedition to the Talamanca Mountain Range on 30 October 2014, the area of Cerro de la Muerte was selected for a field survey of myxomycetes due to its historical record. In particular, a forest patch

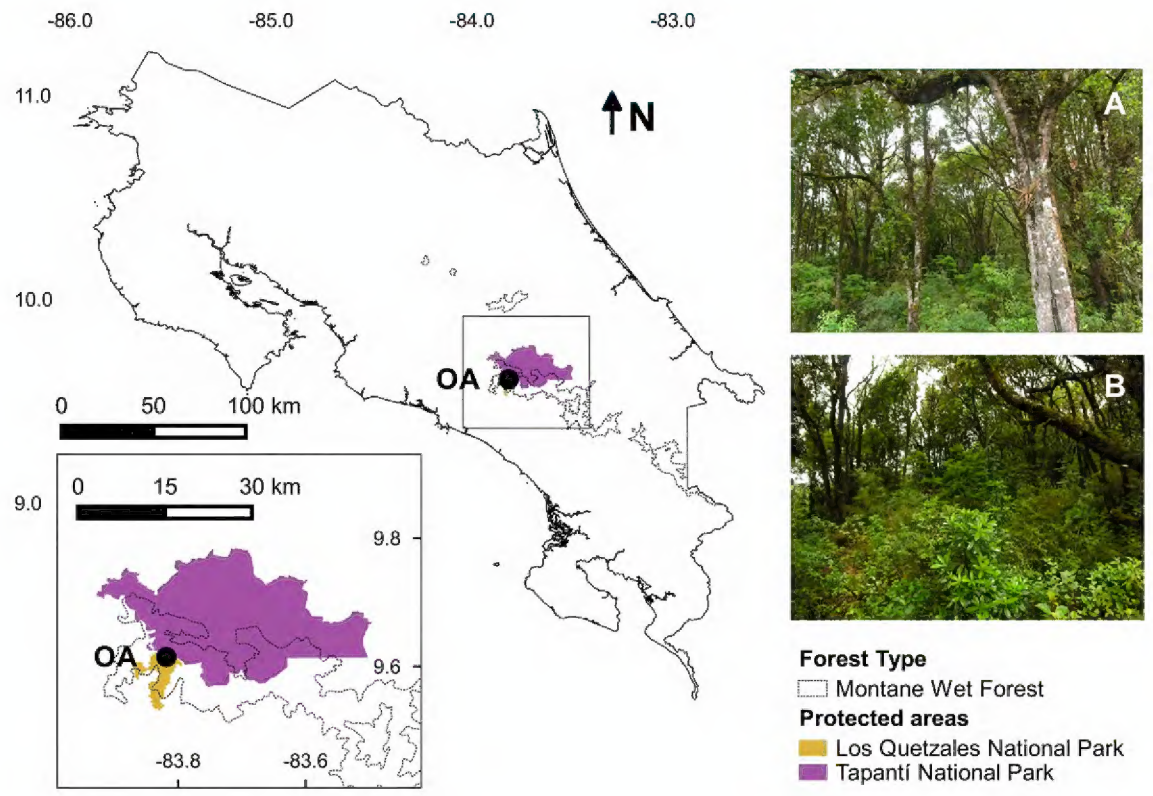

Figure 1. Map of Costa Rica showing the location of the collecting site (OA = Ojo de Agua), the extension of the Tropical Montane Wet Forest and the borders of the two national parks surrounding the site. Insets show a detail of the collecting area and the general appearance (A and B) of the *Quercus* forest patch where *C. oculatum* was found in the northern section of the Talamanca Mountain Range in Costa Rica. Datum used was WGS84.

located on km 77 of the Southern Interamerican Route (Ruta Nacional 2) was selected. This area is located between the Tapantí and Los Quetzales National Parks (Figure 1). The forests comprised between km 50 and 80 of this route have been surveyed for myxomycetes since 1962 (Alexopoulos and Sáenz 1975) and still continued to generate important information for the study of myxomycete biodiversity (e.g., Leontyev et al. 2014).

One specimen of *C. oculatum* was collected in the mentioned patch and brought up to the Forest Resources Unit of the University of Costa Rica for further examination. The fresh collection showed the morphological characteristics of the species according to Lister (1910) and Martin and Alexopoulos (1969). Final identification of the record was carried out by the second author and after curation, the specimen was deposited in the Myxogastrid Biorepository of the Engineering Research Institute under collection number Ro-5395 (see Figure 2). The nomenclature of the species is that of Lado (2005–2015).

The specimen of *C. oculatum* presented herein was found on a dead branch of *Quercus* sp., ca. 7 cm in diameter and with a large load of bryophytes and liverworts on it. The collection was made at the end of the rainy season in Costa Rica and the climate of the area during the previous week was basically clear/sunny with an average temperature of 21°C during the morning, cloudy/rainy and with a temperature of ca. 15°C during the afternoon and clear with a temperature reaching 7°C at night. The forest patch where the collection was made had a canopy openness close to 40%, and the canopy was dominated by the temperate genus *Quercus (Q. costaricensis)* whereas the Neotropical genus *Chusquea* sp. was present in the understory, showing the mixture of species from North and South America.

Description of observed material of *Colloderma oculatum*: Sporocarps scattered to forming small groups of two to three fruiting bodies, sessile, globose to pulvinate, 0.9–1.4 mm in diameter, seating on a broad brownish hypothallus. Peridium double, the outer

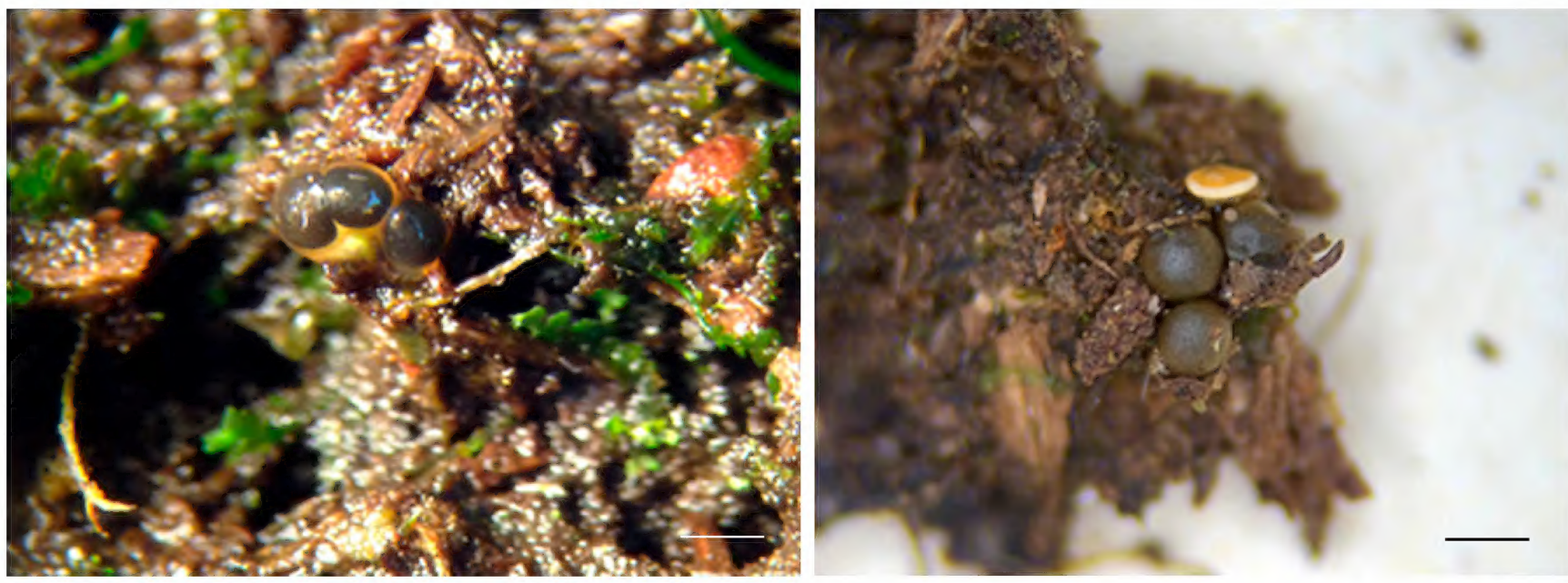

Figure 2. Images of the *C. oculatum* collection Ro-5395 from Costa Rica. Left, moist collection showing the characteristic eye-like appearance of the species in the field. Right, dry collection as seen in the deposited voucher. Scale bar is approximately 1 mm long.

layer thick, hyaline, gelatinous when wet and thin, soft-cartilaginous, glossy olive brown when dry, and the inner layer membranous and hyaline. Columella absent. Capillitium a system of threads coming out of the sporocarp base, 1–3 mm thick, lighter colored at the extremes, with darker accretions. Spores blackish in mass, grayish-brown under the microscope, spinulose, globose to subglobose, 11–13 mm in diameter.

Specimen examined: Costa Rica, San José, Dota, Cerro de la Muerte, Ojo de Agua, 09.61518° N, 083.81869° W, ca. 3,000 m above sea level (a.s.l.), 30-X-2014, on a dead branch of *Quercus* sp. cover with a load of bryophytes and liverworts, leg. C. Lado, C. Rojas & R. Valverde, Ro-5395. The characters found in the specimen examined corresponded very well with those reported in most publications of the species.

It is not surprising to record a new genus and species of myxomycete from Central America given the fact that the study of these organisms in that part of the world has not had the history and characteristics of the European or North American surveys. However, finding *C. oculatum* in a tropical context and in particular in the Talamanca Mountain Range in Costa Rica is very interesting from both a distributional and ecological points of view.

As mentioned before, this species has been primarily recorded in temperate areas and this report is a valuable contribution to its geographical distribution since it extends the occurrence of the genus and the species to Central America. Even though we know of a record from Puerto Rico collected by M. Schnittler at approximately 800 m a.s.l. in El Yunque National Forest (University of Arkansas 2015), the record in the present geographical note provides the necessary evidence to show the distribution of the species in the continental section of the Middle Americas.

What seems more interesting is that the area of Cerro de la Muerte in Costa Rica holds a myxomycete assemblage that resembles the myxobiota of temperate areas located thousands of kilometers away. Even though this area has a clear Nearctic dominant tree (*Quercus* sp.), it also has a large number of tropical plant species of origin in Gondwanaland (i.e., *Chusquea*, *Weinmannia*, members of Cyperaceae; see Iglesias et al. 2011). This issue of myxomycete communities from Cerro de la Muerte resembling temperate ones has been addressed before (see Alexopoulos and Sáenz 1975; Rojas and Stephenson 2007) and it shows the potential of the area for biogeographical analysis and for comparative studies of the evolutionary dynamics of myxomycetes. The latter because even though plant communities in this area are both from North and South America, myxomycete communities resemble those from only one area. From Cerro de la Muerte, Moreno et al. (2009) and Leontyev et al. (2014) recently described species of the genera *Lamproderma* and *Alwisia* that can be currently considered endemic to the zone, also showing the interesting patterns found there.

Independently, the specimen of *C. oculatum* recorded herein was found on a log covered with bryophytes and liverworts in a very similar manner as other habitat descriptions for temperate records of the species (see Lister 1910; Eliasson 1981; Schnittler and Novozhilov 1996; Stephenson 2004). Such observation may indicate that this species requires an appreciable film of water on the substrates that it forms fruiting bodies on, similarly to the lifestyle of both bryophytes and liverworts. Of course, it is somehow intuitive to think that the latter requirement is necessary in a myxomycete species whose fresh fruiting bodies have a wet appearance, but the fact that an already described microhabitat for the species was also recorded in our case may be an indication of an association pattern.

ACKNOWLEDGEMENTS

We would like to thank the University of Costa Rica for support through research codes 731-B4-072 and 731-B5-062 from Vicerrectoría de Investigación. Fieldwork was funded by research activity 731-Bo-986 of the Forest Resources Unit. The work also has been funded by the Spanish Government grants CGL 2011-22684 and CGL2014-52584. Finally, we would like to thank Pedro Rojas from the Forest Resources Unit for his support in the field.

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Authors' contribution statement: CR wrote the manuscript, CL collected and identified the specimen, RV provided illustrations, support in the field and analyzed information.

Received: 28 May 2015
Accepted: 9 July 2015
Academic editor: Matias J. Cafaro